ing and keeping wheat and other types of grass straw, which is infected by red rust, so as to carry out various studies upon the most successful methods of testing the vitality of the spores from week to week and from month to month. We are now able to announce definitely that the vitality of the red spores (*uredospores*) of *Puccinia graminis,* in certain cases, may remain unimpaired by the action of the drying winds of autumn and the intense cold of a North Dakota winter. In some cases we have been able to germinate as high as eighty to ninety per cent. of all the spores under test. We have found these spores successfully surviving upon dead leaves, dead straw and upon the partially dead or green leaves of living grain or grasses. This applies also to a number of other important rusts which attack wheat and allied grasses.

In the case of *Puccinia rubigo-vera,* the smaller wheat rust, it has been found by the writer to be wintering freely in Mississippi, Texas, Illinois, Minnesota and North Dakota both upon living leaves of wheat or winter rye and upon the matured leaves and straw of the same. This fact will of necessity have great weight upon the future investigations of wheat rust. The matter of the barberry stage and other æcidial rusts may yet be proved to be of physiological necessity for the perpetuation of the species, but it would seem that these need no longer be believed to be a direct yearly necessity to the perpetuation of the rusts concerned.

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CONCERNING THE IDENTITY OF THE FUNGI CAUSING AN ANTHRACNOSE OF THE SWEET-PEA AND THE BITTER-ROT OF THE APPLE.

ABOUT a year ago I received some sweet-pea stems from Inwood, W. Va., with a request as to the cause of the plants dying. These stems had dead, shrunken areas on them with masses of pink spores scattered about over the dead areas. There were also a few spore masses on some of the leaves. An examination showed that the dead areas were probably caused by some species of *Glœosporium,* but no such fungus has been found as occurring on the sweet-pea in the literature that I have had access to. I have called the disease an anthracnose on account of its resemblance to the anthracnoses of some other plants.

More material was secured at different times during the autumn, and it was my intention to make a personal investigation of the disease until after Mr. A. Lee Post became officially connected with the experiment station and a student in the university, when the problem was assigned to him under my direction. He began a study of the life history of the fungus by means of artificial cultures and inoculations. The results of the investigation, up to date, have been presented in the form of a thesis, and will probably be published later with slight alteration and the addition of new data.

While examining some of the agar cultures with Mr. Post, I noticed that there was an occasional cell of the mycelium that contained spores, the number of spores in the cells varying. To all appearances the endospores were the same as those borne externally on the hyphæ. This was the first time that I had seen endospores in the mycelium of a fungus other than those found in bacteria, and correspondence with some of the leading mycologists has failed to give me any definite light on the subject of endospore formation in the higher fungi.

The manner of growth of the mycelium and the way the conidia were produced were so characteristic of the bitter-rot fungus of the apple and the one causing the mummy disease of the guava, that Mr. Post made some inoculations in apple-agar and in apples. The result of the inoculations on apples was so similar to the bitter-rot of the apple that a number of mycologists have pronounced it genuine bitter-rot.

Through correspondence with the person who sent me the diseased sweet-pea stems, I learned that the sweet-peas grew near an apple tree, the fruit of which rotted. Just what kind of a rot it was will be determined this fall if possible. This rotting of the apples on the tree near the sweet-peas, suggested the possible identity of the anthracnose of the sweet-pea and bitter-rot of the apple. To prove

whether they are, or are not, the same, I let Mr. Post have some specimens of bitter-rot and of the ripe-rot of the grape collected at least two hundred miles from where the sweet-peas grew. Seedling sweet-peas, inoculated with spores from these two sources, were killed at the point of infection in the same way that the original sweet-pea stems were killed, and other seedlings which were inoculated with pure cultures of the fungus causing the anthracnose of the sweet-pea.

It would seem, then, from the results obtained, as if the bitter-rot of the apple, the ripe-rot of the grape and the anthracnose of the sweet-pea are caused by the same fungus. A stage corresponding to the ascigerous stage of the bitter-rot has not been obtained yet in artificial cultures.

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June 19, 1905.

INDICATIONS OF AN ENTOMOPHILOUS HABIT IN TERTIARY SPECIES OF QUERCUS.

The occasional development of several embryos in the fruits of recent species of *Quercus* is of interest as suggesting an entomophilous habit in the flowers of the Tertiary species of this genus.

At present normally five of the six ovules in the three-celled ovary atrophy, and the one remaining forms later a perfect embryo which fills the entire cavity of the nut. But it not infrequently happens that two embryos develop, each with cotyledons, plumule and caulicle. Experiments made by the writer show that both embryos will grow, and the twin oaks were kept until they reached a foot or more in height. Several cases were found by the writer in which three perfect embryos occurred in acorns of the chestnut oak, *Quercus prinus*. All germinated nearly equally well. Finally a single case was found in which there were four perfect embryos. This also was an acorn of the chestnut oak, which develops several embryos more readily than *Q. alba, rubra* or *tinctoria*.

Several notes have been previously published on the development of two embryos in *Quercus*, but I have not found any record of three or of four perfect embryos occurring in this genus.

The normal abortion of five ovules and reduction to one embryo seems to be an acquired character, and in the development of several embryos appears to be a reversion to an ancestral condition.

Now, it is well known that the formation of several or many embryos is characteristic of entomophilous flowers, but very rare among anemophilous.

This suggests that the oaks of the Greenland Tertiary flora were entomophilous, that their flowers were more conspicuous, and that their fruits normally developed several embryos. With the oncoming of the ice sheet the oaks moved very slowly southward because of the inadaptability of the fruit for wide dispersal. Deserted by the insects seeking the warmth farther south, the oaks may then have adopted their present anemophilous habit.

Paleobotany so far can give no evidence either for or against this theory, but later studies of the Tertiary floras may strengthen the indication now furnished by the development of two, three and four embryos in cases of reversion in *Quercus prinus*.

C. J. Maury.

BATHYGNATHUS BOREALIS, LEIDY, AND THE PERMIAN OF PRINCE EDWARDS ISLAND.

A few days ago I had occasion to examine the figure of *Bathygnathus* published by Leidy in his original description (*Jour. Acad. Nat. Sc. Phila.* (2), 11, pp. 327–330, pl. XXXIII.) and became convinced that it was not a dinosaur, as has been long supposed, but one of the most specialized of the pelycosaurs, such as occurs in the Texas region, probably a *Dimetrodon* or *Naosaurus*. I communicated with Dr. Lambe, of the Canadian Survey, indicating my belief that this settled the question of the possible occurrence of Triassic deposits in Prince Edwards Island. Almost all of the geologists of the Canadian Survey who have worked on the island have considered the rocks as Permo-carboniferous and have